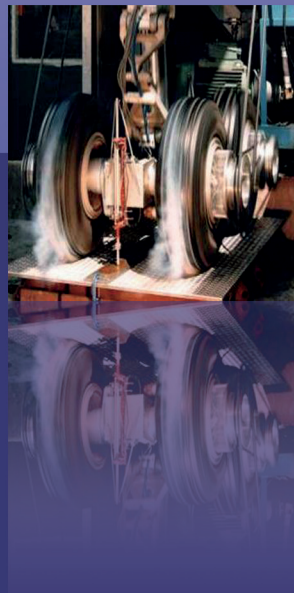


Fatigue, Durability and Lifing Solutions for Aerospace Applications

- Design
- Analysis
- OLM and HUMS
- Data Warehouse



HBM-nCode

For many years, aerospace companies have maintained the reliability, safety and robust operation of aircraft and equipment by trusting in nCode's powerful and highly versatile software solutions. Our latest generation of graphical, process-centric software provides a well-tried and tested basis for a 'Physics of Failure' approach to determining fatigue and durability throughout the product lifecycle. However, we fully understand that aerospace companies have individual, often unique requirements and with this in mind we have designed our solutions to enable you to easily facilitate the interaction of your own proprietary programs with our software modules.

All nCode analysis solutions share the same user interface, architecture and algorithms. As an example, this holistic approach allows direct correlation between operational flight loads and the original design and validation tests. This leads to increased confidence in safety and performance, and an ability to implement CBM initiatives.

Product Lifecycle Performance

Modular software products for monitoring, analyzing and predicting performance .

Save money, resources and time:

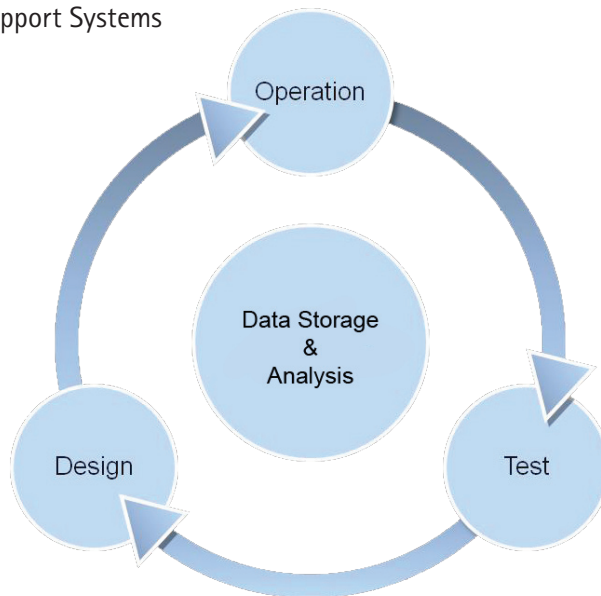
- // Accelerate design evaluations and design changes
- // Extend the life of existing systems and improve maintenance scheduling

Reduce operational failures:

- // Increased reliability
- // Rapidly understand the impact of system modifications
- // Understand impact of mission changes
- // Improve deployment scheduling based on structural integrity—mission readiness

- // OLM – Operational Loads Monitoring
- // HUMS – Health and Usage Monitoring Systems
- // Aging Aircraft Support Systems

- // CAE-based Fatigue Analysis
- // Virtual Test Rig Simulator
- // Damage Tolerance Analysis
- // Materials Characterization



- // Structural Test
- // Engine Test
- // Environmental Test
- // Flight Test
- // Accelerated Flight Approval
- // Human Factors Assessment

Measure, Predict and Design with Confidence

● Operation



OLM / Flight Data Ground Station

- Understand usage severity by automatically validating and characterizing measured data

HUMS Ground Station

- Automatically assess damage and trends to warn of durability issues using "Physics of Failure": plus, identify CBM and RCM requirements

Aging Aircraft Support Systems

- Assess life extension or operational restrictions by integrating HUMS information with design models and test results

● Test



Structural, Environmental and Engine Test Analysis

- Increase value of tests by rapidly analyzing test results and trends over thousands of channels
- Accelerate flight approval by simplifying and accelerating tests
- Qualify components for service on different aircraft platforms by using existing evidence

Flight Test

- Automatically validate and convert data into information for design and certification teams and qualification
- Increase value by providing consistency between design, structural and flight test information

Human Factors Assessment

- Whole body shock and vibration assessments

CAE-based Fatigue Analysis

- Identify where and when fatigue failures will occur

Virtual Tests

- Accelerate development by modelling structural performance to predict test results

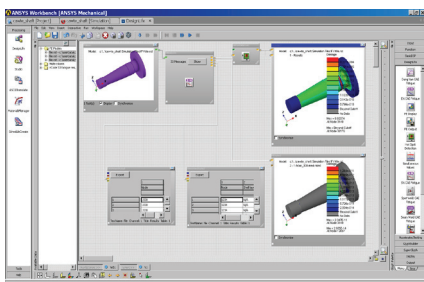
Durability & Damage Tolerance Analysis

- Optimize inspection periods by understanding critical crack sizes and growth rates

Material Characterization

- Deliver the right material properties for modelling and evaluation

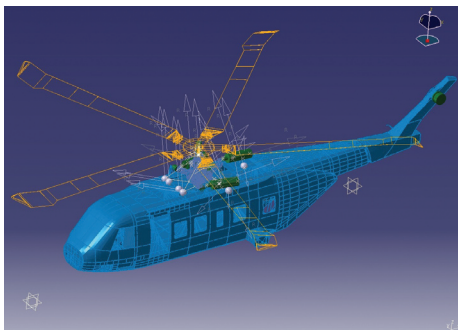
● Design



Aerospace Design Applications

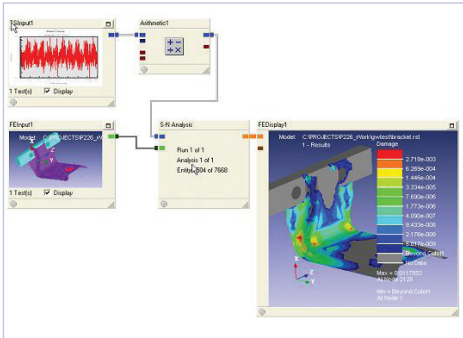
Aerospace design and engineering can be extremely demanding on software applications. Processes have to be rigorously applied and controlled, so software solutions must be well designed, easy to understand, consistently repeatable, and straightforward to execute. With nCode GlyphWorks software you can build an entire analysis and reporting process by simply dragging analysis components (called 'glyphs') and connecting them to form processes, which can be 'locked down' to enforce QA procedures and protect your IP if required. There are extensive glyph libraries available to analyse everything from multi-gigabyte files of measured flight and test data, to large FE stress models, all within the same user environment. You can also extend this functionality by embedding your own algorithm glyphs or interacting with your existing code.

This consistent use of algorithms and user interface allows OLM, test and CAE design data to be combined to facilitate correlation studies and operational HUMS.



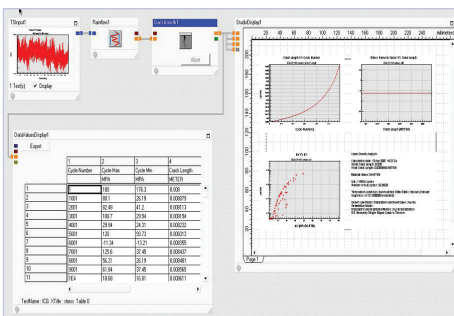
CAE-based Fatigue Analysis

- // Identify when and where failure could occur
- // Multi-axial SN and EN fatigue analysis (including elevated temperatures)
- // Non-linear and linear FE analysis of transient or quasi-static loading
- // Simple to complex multi-axial loading spectra



Virtual Tests

- Accelerate evaluation and minimize prototype tests and costs (e.g. MIL-STD-810F) by predicting the structural performance directly from FE models



Damage Tolerance Analysis

- Optimize inspection intervals by predicting critical crack lengths, growth rates and estimating maximum permissible flaw size
- Perform forensic failure studies (including estimation of initial flaw size - EIFS)



Material Characterization

- Provide accurate and comprehensive material properties for:
 - Fatigue life prediction and analysis
 - Comparison of material supply sources for consistency of quality

Aerospace Test Analysis Applications

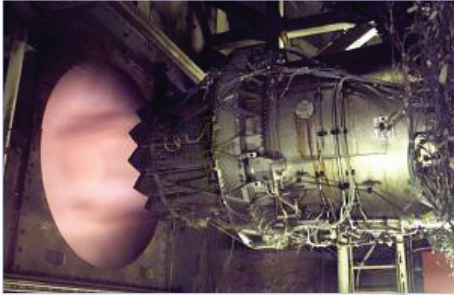
Aircraft development, testing, and monitoring programmes can, and frequently do, generate vast amounts of data. nCode GlyphWorks software is a comprehensive solution for de-noising and analysing measured test data gathered from multiple sources. A complexity of measured data can be quickly transformed into easy to understand information and reports from which informed engineering and management judgements can be made.

Analysis is performed using our graphical process environment. Within this environment you can quickly build complex analysis processes which are capable of handling thousands of channels of measured data. Open file formats and common data models permit you to share data between other software packages and enables tests to be correlated closely with design so designs can iterate swiftly to completion.



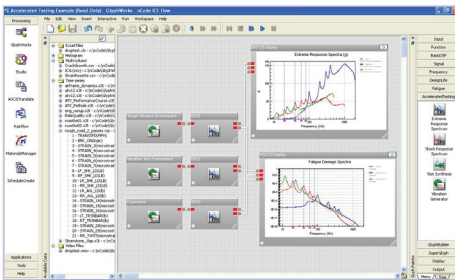
Structural Test

- ✓ Automatic data validation, processing, trending and fatigue analysis
- ✓ Automatic alerts for trends defining onset of failure and excessive fatigue accumulation rates
- ✓ Analyze and understand all types of data



Engine Test

- Vibration analysis with order extraction
- Octave analysis
- Noise weighting functions
- Joint Time Frequency Analysis (JTFA)
- Frequency Response Function Analysis (FRF)



Environmental Test

- Simplify, tailor and accelerate realistic shock and vibration tests
- Qualify components and systems for service on different aircraft platforms using existing evidence
- Equipment re-living and de-living assessments



Flight Test

- Improved quality and availability of information for design and certification teams through automatic data validation and upload
- Understand mission readiness and usage severity
- Advanced data analysis, trending and reporting

Human Factors Assessment

- Whole body shock and vibration assessments

Aerospace OLM and HUMS Applications

Many aircraft being built today will still be in service years from now and an increasing number of operational aircraft will be subject to re-lifing. nCode software has specific application to OLM (Operational Loads Monitoring) and HUMS (Health and Usage Monitoring) to provide engineers and operators with the tools they need to have confidence in the continuing airworthiness of aircraft throughout their lifecycle.

An OLM ground station uses measured flight load data to determine how aircraft are being used. nCode software can be used in this application to process thousands of channels of data and offers advanced analysis capabilities for signal de-noising, flight event characterization, prognostic and diagnostic damage modelling, vibration analysis and statistical trending by using nCode's intuitive visual processing environment.

A HUMS ground station predicts durability issues, assesses mission readiness and gives additional insight into usage trends. nCode software enables automatic data analysis upon upload and issues alerts and usage reports to nominated stakeholders. nCode solutions are unique in offering an introspective analysis feature to 'mine' the stored data using advanced 'Physics of Fatigue' analysis techniques. New detection processes can be added to a HUMS ground station at any time and the retrospective analysis features mean you can process all the archived data using the new processes; for example, to establish the health of any aging aircraft. This unrivalled functionality ensures a 'future-proof' system which can develop to capture service experience and obviate the risk of obsolescence.



OLM Ground Station

- Understand usage severity by automatically validating and characterizing measured data
- Categorize manoeuvres and flight events to understand the loads generated
- "Future-proof" long term usage by performing retrospective analysis on archived data at any time when new methods are implemented



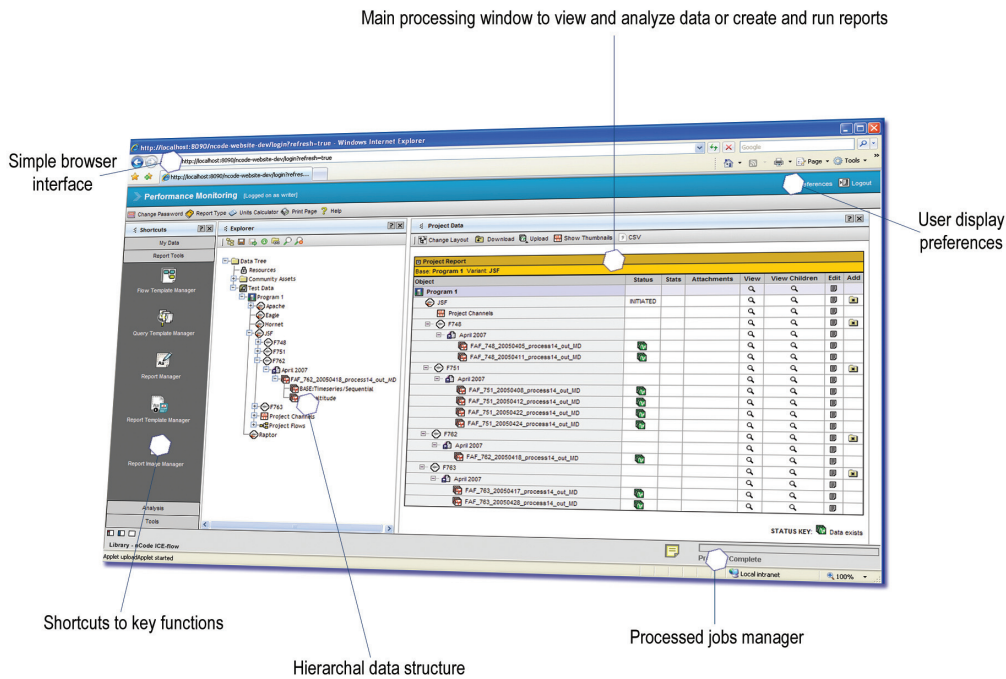
HUMS Ground Station

- Automatically assess damage and trends to warn of durability issues using "Physics of Failure"
- Schedule maintenance based on CBM and RCM initiatives
- Determine mission readiness by:
 - Comparing usage severity across the fleet
 - Diagnostic trending
 - Prognostic analysis
- Re-lifing analysis

Aerospace Data Warehouse Applications

nCode Automation was designed with collaboration between design and test in mind. Traditionally, test and development engineers have maintained their own 'data stores', quite often on a file store on their own departmental network.

With the huge amount of data generated from aircraft, cataloguing and management of data becomes an issue in itself. Add to the fact that the data stores don't communicate with each other and it can be readily understood why such collaboration, at data level, is seldom achieved. But nCode Automation is much more than just a data management system. It incorporates all the mathematical analysis features seen in our Design, Test and OLM applications to allow fully automatic batch processing of thousands of channels of measured flight and test data.

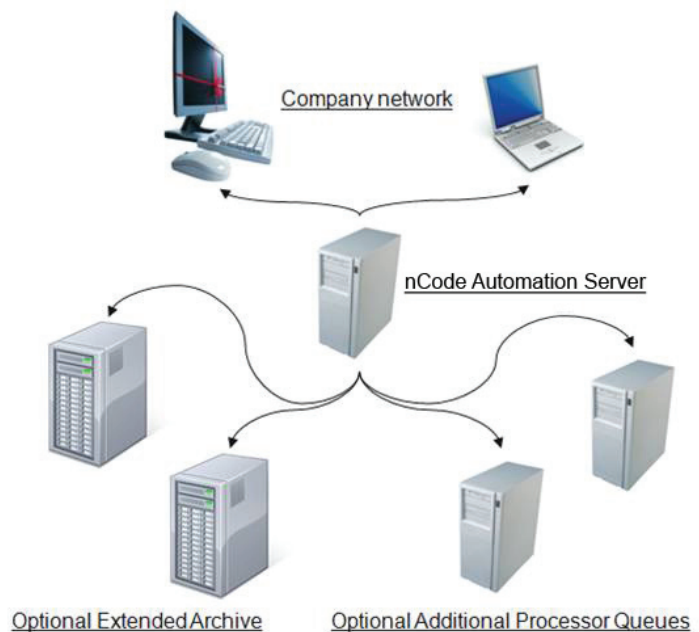


- ▀ Provides consistent information and processes between design, test and flight operations
- ▀ Maximize availability of information throughout organizations while meeting import/export compliance requirements
- ▀ Server-side analysis avoids complex client desktop software proliferation and large file transfer

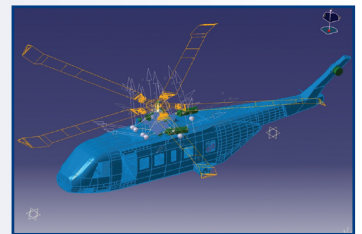
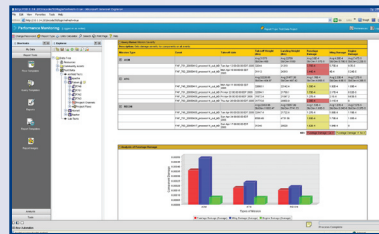
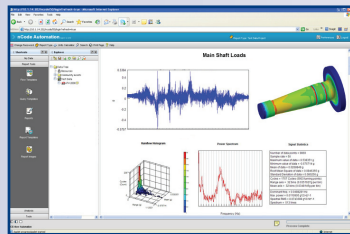
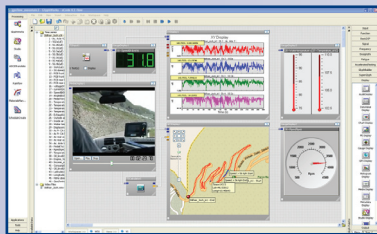
For example, data can be automatically processed on upload into nCode Automation. Automatic file format conversion, signal analysis and de-noising can be performed; followed by advanced fatigue and diagnostic analyses with alerts and reports automatically generated by the application. New analysis routines, created visually in our design and test applications, can be uploaded to the system at any time to permit truly versatile data mining searches and retrospective analysis capabilities. You can even process archived data using new processes! All the analysis is performed locally on your servers so there is no need to transmit huge data sets over the network. You can start your data warehouse on a single desktop machine and grow into a workgroup, or enterprise network.

And searching, processing and downloading data can be done from anywhere in the world simply by using a web browser.

- Secure internet-based communications
- Automated Data Storage
- Automated Data Analysis
- Automated Report Generation



- "Future-proof" system that captures evolving experience and can rapidly re-process legacy data
- Maximum flexibility to instantly access information while recognizing required privileges and restrictions
- Scalable solutions from single server to multi-platform systems



nCode 
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Read more about HBM-nCode products at:
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